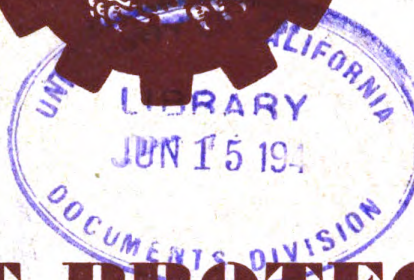


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PLANT PROTECTION FOR MANUFACTURERS



WAR DEPARTMENT

PAMPHLET, No. 32-1

PREPARED JOINTLY BY THE ARMY AND THE NAVY

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WAR DEPARTMENT,
WASHINGTON, May 1, 1943.

Pamphlet No. 32-1, Plant Protection for Manufacturers, is published for the information and guidance of all concerned.

[A. G. 004 (3-18-43).]

BY ORDER OF THE SECRETARY OF WAR:

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The Adjutant General.*

WAR DEPARTMENT
OFFICE OF THE UNDERSECRETARY OF WAR
WASHINGTON, D. C.

FOREWORD

This is a revision of the pamphlet with the same title issued by the Plant Protection Division, Office of the Under Secretary of War, in February 1942.

To prevent avoidable destruction, interruption, or delay in the production and delivery of munitions and other material essential to the prosecution of the war, the War and Navy Departments have set up certain standards and requirements in order (1) to provide for the security of plants and facilities against all hazards, and (2) to safeguard information that might be of value to the enemy. The purpose of this pamphlet is to provide manufacturers with a guide to these standards and requirements.

What applies to one plant may not be applicable to another, and although principles of protection will remain the same, standards and requirements will vary in their application. This requires that a determination be made for each individual plant by representatives of the War or Navy Department (plant protection inspectors), in collaboration with management.

Protection against all normal hazards is a responsibility placed squarely upon the shoulders of manufacturers. Inspections and recommendations are made to assist manufacturers, and to assure that our vital war industries are thoroughly protected against all hazards.

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PLANT PROTECTION FOR MANUFACTURERS

I. SABOTAGE AND ESPIONAGE

I. SABOTAGE.

Even in peacetime, sabotage and malicious mischief are a constant hazard and may result in serious damage and delay to production. In wartime the desire of our enemies to disrupt American production becomes a serious consideration. The fact that enemy trained saboteurs were landed on our shores in the summer of 1942 indicates the importance the enemy attaches to this method of attack from within.

Although there has been no proof, since the start of this war, of any organized, enemy-inspired sabotage, it would be dangerous to accept a complacent attitude for this reason and assume that enemy sympathizers, and enemy agents in this country are unaware of the vital importance of our war production to eventual victory, and that they have neither plans nor intentions of seizing opportunities that may be presented, to cause serious destruction and delays to the production of war materials.

The saboteur may be sly and furtive. He may strike when least expected, and attempts frequently to avoid suspicion by making his depredations appear to result from natural causes.

It is essential that we remain constantly conscious of danger, estimate carefully all opportunities open to a saboteur, and provide the most effective defense possible.

There are enumerated below some of the more probable methods of sabotage. It is urgent to consider and provide protection against these or other forms particularly applicable to your plant:

a. Damage to machines, equipment, or materials by breakage, manipulation, abrasives, chemicals, or foreign bodies. This includes the introduction of damaging elements into a machine through the medium of lubricating oils which may have been polluted.

b. Damage to irreplaceable machinery, equipment, or buildings by time bombs, gas explosions, incendiary bombs and devices, or other explosives.

c. Damage to power stations, transmission lines, transfer stations, switchboards or other key points of the power system, including damage to the

water supply system, gas installations, lighting systems and telephone or other communications system.

- d. Tampering with gages, precision tools, or technical mechanisms.
- e. Tampering with blueprints, formulae, or working models.
- f. Bacterial infection or other pollution of water and foodstuffs.
- g. Creating conditions conducive to accidents or injury of personnel.
- h. Damage by arson, taking advantage of existing fire hazards to allay suspicion.

2. INDUSTRIAL INFORMATION SOUGHT THROUGH ESPIONAGE.

Espionage agents, and spies for profit, are interested in almost all information relating to war industries. The following types of information are likely to be the most frequently sought:

- a. Improved methods of production.
- b. Type of material being produced.
- c. Ultimate destination of completed units, and the means of transportation to such destination.
- d. Rate of production and capacity.
- e. Quantity of articles on order by this and other governments.
- f. Specifications, formulae, and plans of all munitions and war equipment.
- g. Test records of newly developed munitions, airplanes, guns, torpedoes, and related equipment.
- h. Sources of supply of raw materials and/or partially machined materials.

3. TACTICS OF SPIES.

Espionage agents may exhibit unlimited ingenuity in collecting pertinent information for their governments. Following are examples of tactics to which spies and enemy agents may resort in obtaining information regarding industrial plants:

- a. Infiltration of spies into plants as employees.
- b. Obtaining admission as a privileged visitor, or inspector, through impersonation or other fraud.
- c. Purchasing information from employees.
- d. Theft or purchase of plans, specifications, and other confidential documents.
- e. Making copies of documents.
- f. Photographing working models or finished products.
- g. Reproduction or theft of working models or finished products.
- h. Questioning employees either openly or under pretext.
- i. Enticing employees who are particularly familiar with the production of secret and confidential materials to enter the services of a foreign power and serve in an advisory capacity for the production of similar war munitions.
- j. Reporting personal observation and study of production operations, test runs, or confidential papers.
- k. Foreign espionage rings disguised as commercial concerns, import-export associations, scientific organizations, insurance agencies, businessmen's groups, and engineering organizations may attempt to obtain confidential or

other information of benefit to a foreign power. Instances are known where a single foreign agent has become associated with a legitimate and loyal association or organization, as a member thereof, and under apparent legitimate circumstances, obtains information of value which would not otherwise be disclosed.

l. Pressure and threat with reference to relatives and friends, of an employee, who reside in a foreign country.

m. Skillful extraction of information of value to the enemy from members of the family or close friends of an employee.

n. Information obtained in public and semipublic places where groups of employees congregate for social or other purposes and where conversation is not restricted.

4. EMPLOYEES AS A FACTOR IN THE PREVENTION OF SABOTAGE AND ESPIONAGE.

The greatest single protective factor in industry can be the understanding and aggressive cooperation of all loyal employees. It is unquestionable that the vast majority of employees is patriotic and anxious to contribute wholeheartedly to the war effort. The value of this great reservoir of assistants is incalculable, for as a group they—

a. Know all details of operation more completely than either plant management or undercover men;

b. Know their fellow workers far more intimately; and

c. Can be trained to exercise an ever-present and all-inclusive surveillance.

Thoroughly effective cooperation of employees cannot be expected or secured without education and training in the problems involved and the discipline essential. The more important points relative to which employees should be educated are—

a. Willing acceptance of the unpleasant fact that all employees must be inconvenienced by the many rules and regulations designed to trap or thwart the few subversives.

b. The dangers of talking business away from the job.

c. The dangers of hysteria and disaffection which may be inspired by subversive organizations.

d. The dangers of spreading unconfirmed rumors, such as "Made in Japan."

e. Detection of and reporting trespassers.

f. Observance of suspicious characters and their actions.

g. Avoidance of unwarranted approaches by strangers anywhere.

h. Avoidance of association with dubious characters.

i. Avoidance of suspicious promotional offers involving lurid business or financial opportunities.

j. Noting and reporting unusual equipment failures and accidents.

k. Familiarity with the tactics of spies and saboteurs.

To be effective, educational work of this character must be continuous. Furthermore, it must be sufficiently appealing to capture the interest and imagination of the employee. Experience indicates that the most effective form

of education is the informal, on-the-job instruction conducted by the employee's immediate supervisor. Here it is possible to use actual, everyday examples to illustrate general principles, thus fixing the problems and responsibilities more firmly in mind than by depending entirely upon classroom or textbook instruction. The written text usually serves better as reference material for the supervisor than for the employees whom he instructs.

✓ 5. NECESSITY FOR EMPLOYEE IDENTIFICATION.

Spies or saboteurs may attempt to gain physical access in order to plan or carry out their assigned mission. It is required, therefore, that plants and facilities essential to the prosecution of the war maintain an identification system whereby employees may quickly and positively recognize a stranger, or an employee outside his proper area.

In some small plants, this may be accomplished by personal recognition, but in larger plants, a positive employee identification system must be established and enforced. Adequacy of this identification system will be determined by personnel of the plant protection inspection service. Minimum standards normally will require the following:

a. Individual identification.—The most practical method is by identification card or badge. The badge pinned to the clothing is preferred, and is essential in large plants. It is visible at all times and is less liable to be lost. The badge system should meet the following requirements:

- (1) The badge itself should be of tamperproof design.
- (2) Make-up and issue rigidly controlled to minimize counterfeiting or theft, and insure return upon termination of service.
- (3) Every employee to wear his badge at all times within the plant area.
- (4) Badges always to be worn in a uniform place on the clothing.
- (5) Badge to include either a photograph or descriptive information sufficient to identify readily and positively the badge with its wearer (photograph is preferred).
- (6) Visitors should be issued special badges or passes as indicated in the section on "Visitor Control" (see pages 7 and 8).

b. Movement restrictions.—Enemy agents may not be stupid and may be within war plants as presumably "loyal" employees, with identification card or badge. Restriction of movement is therefore necessary as an added precaution. In very large or vital plants, an individual badge should be valid only for one shift or for one section of the plant. A badge system using different colored backgrounds, for example, will help spot an employee not in his own department, or in the plant during an unauthorized period. Such an employee should be challenged by the nearest person and required to show a special pass signed by his foreman. An employee entering or leaving at off-shift hours may be controlled in a similar manner.

c. Enforcement.—No identification system is better than its enforcement. It is probable that a clever intruder will be revealed, not by a glaring fault, but by an otherwise minor error. Rigid enforcement is therefore a requirement. Although this is a primary responsibility of the plant guards and foremen,

each employee must do more than his share towards maintaining strict compliance.

An excessive number of lost or "forgotten" badges is often accompanied by excessive absenteeism, continued "labor troubles," low morale, or other indications of poor executive control by plant officials.

6. INVESTIGATION OF EMPLOYEES IS ESSENTIAL

Employees are in a very favorable position for accomplishment of sabotage or espionage. Positive determination of their loyalty is of extreme importance in time of war. Investigation of actual or suspected cases of espionage or sabotage is a function of the Federal Bureau of Investigation, United States Department of Justice. To avoid such cases the plant management must exercise every possible precaution to determine that persons who make application for employment are loyal and dependable.

a. Minimum information on employees at plants and facilities essential to the prosecution of the war is as follows:

- (1) Fingerprints as required by War and Navy Departments.
- (2) Personal history to be entered on an employment application form approved by your plant protection inspector.
- (3) Routine mail or telephone check on references, particularly previous employers, and a check of important or doubtful statements appearing on the application form.

b. Additional information required in special cases:

- (1) Aliens may be employed on classified or aeronautical contracts only with prior consent of the Secretary of War or the Secretary of the Navy. Consent may be requested by submission of the forms provided.
- (2) Selected employees may be required to submit additional personal data upon the request of a service command representative or plant protection inspector.

c. *Special workers* are those stationed in the plant but employed by others, such as contractors, consulting engineers, or caterers. Investigation of this personnel depends entirely upon circumstances, and may consist of anything from a complete check, down to a simple statement of loyalty.

d. *Suspected disloyalty* for any reason or cause will be reported at once to the nearest office of the Federal Bureau of Investigation.

7. FINGERPRINTING.

All present employees and applicants accepted for employment in plants and facilities vital to the war effort are required to be fingerprinted. Other plants and facilities desiring to participate voluntarily in this program may be permitted to do so by the commanding general of the service command concerned.

The purpose of the program is to identify persons whose criminal records indicate that continued employment in their present positions may endanger the war effort. Criminal records are confidential and for the exclusive use of War and Navy Departments personnel, who evaluate the information and initiate appropriate action in accordance with the purpose of the program as

set forth above. The War and Navy Departments are not primarily concerned with the morals of employees, and disregard criminal records unless they disclose tendencies that may make their employment a risk. Production of war materials is of critical importance and every person who can contribute without endangering the war effort will be permitted to do so.

8. PROTECTION OF THE PLANT AREA AGAINST UNAUTHORIZED ENTRY.

Access to the plant must be so arranged that intruders may be excluded or captured, and visitors controlled.

a. Physical requirements.

- (1) *Fencing* is the most effective barrier. Present metal shortages require the use of ingenuity in designing suitable fencing from available material.
- (2) *Entrances* should be kept at a minimum number. They should be locked or guarded at all times.
- (3) *Screening* should be used on all vulnerable windows, ventilators, drains, or other small openings.

b. Enforcement.—No physical barrier is effective unless backed up by human observation. Fences, locks, and bars will delay but will not stop a determined intruder. All employees should be on the alert to spot any unauthorized entry.

c. The guard force normally will be the principal enforcement agency. Static guards are required at all unlocked places of entry to control all persons entering or leaving. Roving guards must be provided to patrol all other vulnerable points of possible entry.

Guards and watchmen should make regular patrols of the entire plant, with special attention to areas likely to be of particular interest to espionage or sabotage agents. Guards should vary their routes occasionally so that their appearance at any given point cannot be anticipated. Guards' and watchmen's rounds should be arranged so as to cover the interiors and exteriors of all important buildings. Watch-clock stations should be so located that all points of the plant and yard will come under the observation of a guard or watchman on each round.

Fences must be inspected on each round and watch should be kept for foreign objects which might be used for sabotage purposes, or to facilitate entrance to the plant. Locked gates and entrances must be checked and any abnormal condition immediately reported.

Trucks and railroad cars should be checked by guards at points of entrance. In important plants, guards should be stationed at receiving and shipping platforms to keep unauthorized persons away and to make sure that no unauthorized or damaging materials are brought in or shipped out.

In general, guards should have no duties other than the maintenance of plant protection. In small plants, however, watchmen may sometimes assist firemen, start process heaters or furnaces, etc., provided such duties do not interfere with their regular rounds or other guard functions.

Parking lots preferably should be outside the plant yard, but if within or adjacent to plant areas they should be separated by fencing so that all employees will have to enter the plant through pedestrian entrances. All persons entering the plant areas by automobile should be positively identified, and in case of any doubt the contents of automobiles should be carefully checked. Visitors who are not personally known should be required to park their automobiles outside the plant area.

9. VISITORS.

a. Responsibility.—The primary responsibility for the control of visits to and visits within any plant, facility, or installation rests with the commanding officer of the Government-operated plant, facility, or installation, and with the owner and operator of the privately operated plant, facility, or installation. Thus, all authorizations to visit are subject to approval or disapproval by the person primarily responsible.

b. Limitation of visitors.—No visitor will be admitted except for a legitimate and necessary purpose. This restriction applies to all, including Army and Navy representatives, and all other Federal or local government officials.

c. Special visitors.

- (1) Reporters, photographers, and other representatives of publicity agencies may not be admitted to a manufacturing establishment engaged on war contracts unless accredited by the Bureau of Public Relations of the War Department or the Office of Public Relations of the Navy Department, and unless the purpose has been made known to, and approved by, the plant management beforehand.
- (2) Foreign nationals (except Canadians) and United States or Canadian citizens representing a foreign government or organization will be admitted only on written authority of the Assistant Chief of Staff, G-2, War Department General Staff, or the Director of Naval Intelligence.
- (3) State and local officials making inspections required by State laws and local ordinances may be admitted without prior authorization from representatives of the Army or Navy.
- (4) Firemen, policemen, physicians, nurses, and similar authorities may be admitted in an emergency without prior authorization. In an emergency every reasonable precaution will be taken to prevent persons from taking advantage of confusion to make unauthorized entry.
- (5) Casual visitors, such as salesmen or applicants for employment may be admitted by the plant management under established rules and restrictions approved by the plant protection inspector.
- (6) Properly identified agents of the Federal Bureau of Investigation may be admitted to the plant without prior authorization from representatives of Army and Navy, and should be given all possible assistance in the performance of their duties.

d. Visitors essential to production.—Persons essential to production, such as repairmen, accredited insurance company inspectors, and technical consultants may be admitted by plant management without prior authorization from representatives of the Army or Navy.

e. Control of visitors.

- (1) Visitors will be kept constantly under surveillance, or will be accompanied by a plant, Army, or Navy official.

- (2) ***Each visitor must be prepared to identify himself and, in plants engaged in classified work or projects, to show that he is a citizen of the United States.*** For these purposes the visitor will carry a card, issued by his employer, which adequately identifies him, and whenever necessary, indicates that his citizenship and loyalty have been verified. Although identification cards are not required to follow any specific form, any visitor to an important plant, facility, or installation who does not possess an identification card containing the following minimum information *may* be excluded therefrom by such commanding officer or operator:

- (a) Personal characteristics such as name, height, weight, color of hair and eyes, race, birth date, distinguishing marks.
- (b) Photograph; print of one or both thumbs or index fingers; signature of holder.
- (c) A statement substantially as follows, preferably personally signed by an authorized official of the visitor's employer:

This is to certify that the information hereon is correct; that the person identified hereby is our representative; and that information, verified to the satisfaction of the undersigned, has been presented that he is a citizen of -----, and is loyal to the United States.

An identification card is for purposes of identification only. It is not a pass and does not confer authority to visit a plant or facility, no matter by whom issued.

- (3) Minimum requirements of the War and Navy Departments in the matter of records is a visitors' book showing for each visitor his signature, address, and affiliation, purpose of visit, time of entry and departure, name of plant official granting admission, and ***whether or not the visitor had access to "Secret," "Confidential," or "Restricted" plans or material.***

10. RESTRICTED AREAS.

✓ Power plants, compressor rooms, switch and transformer rooms, experimental laboratories, and rooms in which essential defense material is being processed generally will be considered vital areas. These areas should be restricted from the entrance of unauthorized persons and guarded where necessary. Visitors, except essential repairmen and technical consultants, must not be admitted to restricted areas except on the express authority of a Government inspector.

11. CLASSIFIED INFORMATION.

Classified information is that marked either "Secret," "Confidential," or "Restricted." When sent to civilian organizations, an additional stamp is used reading:

This document contains information affecting the national defense of the United States within the meaning of the Espionage Act, 50 U.S.C., 31 and 32, as amended. Its transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

It is essential to make certain that their handling of classified information does not violate the paragraph of the Espionage Act cited above.

Classified blueprints and other documents must be retained in planning or engineering offices, except when charged out to authorized persons responsible for their return. All classified material should be returned to files and locked up when not in use.

12. ADMINISTRATIVE PRECAUTIONS AGAINST ESPIONAGE.

Keys and safe combinations must be issued only to a limited number of trusted employees. Should such person leave the employ of the company, the safe combinations must be changed promptly.

Waste paper from administrative offices, engineering departments, drafting and blueprint rooms, etc., must be disposed of by burning or shredding so that no classified material can be salvaged and used.

Janitors and charwomen, due to their access to all parts of the plant, have an unusual opportunity to obtain classified information, and by reason of low salaries may have more than ordinary inducement to do so. They must be subject to frequent but irregular surveillance by members of the guard force.

The use of telephones for other than company business should be discouraged.

II. REMOVAL OF SUSPECTED SUBVERSIVES

There are occasions when adequate investigation reveals that there is good cause to suspect an employee of a proclivity for subversive activity, or of engaging in, having engaged in, or preparing to engage in subversive activity in a plant of importance to Army or Navy procurement.

A procedure has been established by joint action of the War Department and Navy Department for the prompt removal of such suspected subversive personnel from employment.

Contractors should immediately notify the Federal Bureau of Investigation and the agency having responsibility for continuing protection at the plant of the presence of any such persons in the employ of the company, together with a statement of the circumstances which need not include concrete evidence sufficient to justify an arrest for violation of the National Sabotage or Espionage Acts.

III. EMPLOYMENT OF ALIENS

Law and regulations prohibit the employment of any alien on aeronautical or classified War and Navy Department contracts without written consent *beforehand* of the Secretary of War and the Secretary of the Navy.

An alien holding first citizenship papers is an alien, and is required to have the foregoing consent.

Application for consent for the employment of an alien must be accompanied by an alien questionnaire, delivered to the agency having responsibility for continuing protection.

IV. PROTECTION OF POWER FACILITIES

A great number of manufacturing plants are dependent upon a continuing supply of electric power for uninterrupted operation. Equipment used for this purpose is subject to ordinary wear and tear as well as to possible acts willfully committed for the purpose of causing damage. The possibility of acts of deliberate damage may be lessened through the restriction of access to vital equipment as already outlined.

In addition to general protective measures discussed elsewhere in this pamphlet, the minimum requirements and the protection of certain vital installations deserve special consideration.

Electric power sources must be ample to provide for a reasonable reserve beyond full load demands; transformers must be of sufficient capacity safely located and protected; distribution lines must be properly installed and supported; power house equipment must be safeguarded from fire and electrical hazards; and admission to power house areas must be carefully restricted.

1. Maintenance of electric generators and motors must be given special attention particularly when it is necessary to exceed rated capacities. The advice of competent electrical engineers is essential before additional loads are added. Temperatures and oil levels must be checked regularly on equipment subjected to overloading. Combustible material should be eliminated from areas containing electric generators. Most generator fires result from short circuits or grounds and usually involve the combustible covering of windings. In open-type generators, first-aid extinguishers such as carbon dioxide, vaporizing liquid (carbon tetrachloride), or small hose (after equipment is electrically dead) can be used effectively. For enclosed-type generators of 3,000 KVA or greater capacity, built-in equipment such as perforated water-spray pipes or carbon dioxide systems are recommended. For generators of less than 3,000 KVA capacity the values involved do not usually warrant the expense of built-in equipment.

Regular inspections of equipment will result in a minimum of unexpected outages from worn and deteriorated apparatus. Plant conditions permitting, electric generating and distributing equipment regularly in use should be

overhauled annually. Inspection of generating and associated equipment should include a consideration of (1) the surfaces and alinement of bearings, the lubricating system; (2) buckets, nozzles, and governing system in the case of a steam turbine; (3) the insulation and physical connections of windings in the case of an electric generator; (4) the tubes in heat exchanger units such as oil coolers and condensers.

2. Transformers having a noncombustible dielectric may be located at almost any convenient place within a manufacturing property, provided they are protected against malicious tampering and mechanical injury. Oil-filled transformers must be at a safe location in noncombustible well-drained vaults, or outside of buildings. Oil-filled transformers of large capacity must be located well away from building walls where they may form a serious exposure. Outside transformers must be adequately fenced, and the resulting inclosure well supervised.

Regular inspections of circuit breakers and transformers should include consideration of the oil, contacts, and control apparatus. It is to be noted that, in many instances, manufacturers of equipment are in a position to provide experienced personnel to assist in making inspections of this nature involving both generating and distributing equipment.

3. Outside overhead transmission lines more than 600 feet long entering or leaving a powerhouse, substation, or transformer bank should be provided with lightning arresters; main conductors must be run in conduit; and grouped wires and lead-covered cables must have noncombustible outer coverings.

4. *Powerhouses.*—Automatic sprinklers can be safely used under plank roofs of powerhouses where voltages do not exceed 600, and there are no large, expensive units. Sprinklers can be safely used with higher voltages if noncombustible, waterproof shields are used over generators and switchboards to prevent water damage.

All powerhouses should have small hose and portable water-spray nozzles as well as an ample supply of carbon dioxide and vaporizing liquid (carbon tetrachloride) extinguishers. Yard hydrants and hose or fixed water-spray systems are desirable also for the protection of large, outside, oil-filled transformers.

5. Competent and special civilian inspection services are available for the safe maintenance of boilers, pressure vessels, and similar equipment, and are highly desirable. All safety devices for such equipment must be kept in good operating condition and should be overhauled periodically.

6. Gas facilities must be inspected frequently for gas leaks. Natural gas should be odorized in order to facilitate detection of gas leaks. All employees should be instructed to report all gas leaks immediately. Special precautions to avoid explosions should be employed even when trained personnel are available to repair faulty gas lines inside buildings. The piping system should be arranged in such a manner that the gas supply entering the building can be controlled from the outside. Control valves should be inspected at regular intervals to insure proper operation.

men, and employees be impressed with the fact that good housekeeping is a prime essential to the war production program, and that carelessness with waste material, a common cause of preventable fires, must be eliminated.

Good management requires good housekeeping conditions, and good housekeeping conditions result in fewer fires. Good general order and neatness do more than reduce the number of fires; they result in fewer accidents and personal injuries; they promote pride in the place of employment; they result in a better product. There is no form of munitions manufacturing where good housekeeping conditions cannot be emphasized from the fire hazard standpoint with resulting benefit to morale, to working conditions, and to product.

Metal waste cans are essential to take care of refuse which might otherwise be thrown into a corner. These cans should be emptied daily before closing time. Self-closing tight covers stifle a fire igniting spontaneously in such a container.

A place for everything and everything in its place is better and more efficacious than periodic clean-ups. Operating efficiency and safety demand well-piled stock kept well below sprinklers, and wide aisles kept clear.

Good housekeeping practices should not be confined to manufacturing areas. Frequent cleaning of lint accumulations or flammable deposits inside exhaust, ventilating, heating, and air-conditioning ducts, conveyors, supply and overflow pipes, dryers, ovens, and spray booths is essential.

Good housekeeping is equally essential outside of manufacturing areas. Rubbish, dry grass, and waste must not be permitted to accumulate outside where it will form an exposure to the plant if fire occurs in such material. There may be other exposure hazards such as the storage of a large quantity of lumber in one area or quick-burning sheds that need to be reduced in number or rearranged as a part of the good housekeeping program.

✓ 4. SUBDIVISION OF VALUES.

A simple, effective means of safeguarding important material from loss by fire is **subdivision**. Wherever possible, storage of essential material, equipment, and finished goods should be so arranged that no single fire or accident can destroy all available units of any particular item. This can be accomplished by storing such units in various locations remote from each other or by separate storage in a single building cut off by physical barriers such as standard fire walls with the openings therein adequately protected.

✓ 5. PHYSICAL BARRIERS.

Large areas invite large fires. Substantial physical barriers or complete fire wall cut-offs are the most effective means of confining a fire and avoiding the destruction of an entire plant. Such cut-offs are essential to divide large areas, to separate manufacturing operations, and positively limit the spread of fire under the most adverse conditions. Automatic fire doors should be provided and well maintained at all necessary openings in walls serving as fire barriers.

Openings between floors such as at elevators, stairways, and chutes must be protected in a manner to prevent the ready passage of fire and hot gases

between floors at such points. Good floor cut-offs, when properly maintained in sprinklered buildings, are effective in retarding the spread of a fire from floor to floor.

6. ELIMINATION OF FIRE CAUSES.

With the development of new processes, the number of danger spots and hazards in manufacturing plants is increasing constantly. It is important therefore in each situation to understand what the hazard is, lay out the process safely, provide essential protective equipment, and, finally, to operate the process carefully. Some common fires are incident to—

- a. Electrical equipment.
- b. Oil and gas fired equipment.
- c. Portable cutting and welding equipment.
- d. Ovens and dryers.
- e. Storage and use of magnesium, aluminum, powder, and magnesium alloys.

There are many other danger spots, such as spray painting, fuel oil, gas, pulverized coal, combustible dust, chemical processes, paper-making processes, and cotton mill operations, all of which must be given special attention in safeguarding industrial plants against damage or destruction by fire.

7. ELECTRICAL MAINTENANCE.

It is essential that electrical equipment be installed and maintained in accordance with the provisions of the National Electrical Code. All wiring must be well supported and protected against mechanical injury. Circuits should be properly protected by circuit-breakers or fuses of correct setting or rating. Switches and fuses should be in tightly closed metal boxes properly secured to walls or posts.

Motors should be kept free from oily deposit or dust. Pendant lamp cords should be maintained in good condition and replaced when worn. All extension lights should be provided with wire guards, particularly where they may come in contact with combustible material. Electrical equipment in areas where flammable vapors or dusts may be present should be of vapor-tight or explosion-proof design, as conditions may require.

8. FIRST-AID FIRE PROTECTION.

a. *Need for equipment.*—First-aid fire-fighting equipment such as fire pails, extinguishers, and small hose are of particular value during working hours or in the hands of a good watchman, if used promptly and with good judgment on incipient fires. A surprisingly small amount of extinguishing liquid will generally extinguish a fire in ordinary combustible material if it is promptly and properly applied. "A little fire is quickly trodden out, which, being suffered, rivers cannot quench."

b. *Choice of equipment.*—It is essential that throughout manufacturing properties there shall be instantly available something with which to extinguish a fire. In choosing the most effective equipment, consult a competent fire protection engineer with broad experience in manufacturing hazards and follow his advice. It is advisable to confine purchases of fire-extinguishing

equipment to that which bears the approval of the Underwriters' or Factory Mutual Laboratories.

c. Combustibles of different types require special equipment.—Pump tanks, water-filled-cartridge or soda-acid type extinguishers are quite suitable for use on fires in ordinary combustibles and should be available on the basis of one 2½-gallon extinguisher for each 1,500 to 2,000 square feet of floor area. Water pails in ample number and well maintained provide excellent first-aid protection for many occupancies. Foam type extinguishers are recommended for the protection of dip tanks and other flammable liquid containers. Carbon dioxide extinguishers are useful for running fires in small amounts of flammable oils and gases, for electrical fires, and where delicate or valuable equipment may be damaged by the use of other types of extinguishers. Vaporizing liquid (carbon tetrachloride) is a nonconductor of electricity, hence extinguishers of this type are recommended where electrical fires may be anticipated. Approved dry-chemical type extinguishers are effective on floor and spillage fires and on fires in small containers of flammable liquids. Automatic foam equipment is frequently advisable for large dip tanks and other flammable liquid containers.

d. Maintenance of extinguishers—accessibility.—Keep extinguishers full and in good working order. With several types it is advisable to have them discharged and recharged annually. If the shell of a pressure type extinguisher is dented or shows signs of corrosion, the extinguisher should be given hydrostatic test. Place extinguishers where they are readily accessible. Alternated red and white bands or red lights on posts or walls will aid in promptly locating fire-fighting equipment.

e. Extinguishers should be sealed.—During the war emergency it is desirable to seal extinguishers to prevent malicious tampering. With the conventional soda-acid, foam, water-filled, and dry powder types this can be accomplished by using cheap lead and wire seals commonly known as "freight car" seals. The wire is passed around one of the supports of the extinguisher cap and then around the discharge pipe of the extinguisher and sealed. This prevents opening the extinguisher without breaking the seal but does not interfere with its use or discharge. Small vaporizing liquid (carbon tetrachloride) pump-type extinguishers can be sealed by passing gummed paper around the extinguisher and the bracket on which it is mounted. This paper seal may be dated and if broken will be prima facie evidence that the extinguisher has been handled. All extinguishers should be checked for contents and operating condition before sealing.

f. Maintenance of hose.—Unlined linen hose should never be tested with water, and after its use for fire purposes should be thoroughly dried before returning to service. Examine the hose fabric near the standpipe coupling for signs of mildew due to leakage, and make sure that the nozzle is attached and hose is so stored that it can be quickly used without kinking.

g. Training in use of equipment is essential.—Some types of first-aid fire-fighting equipment are surprisingly effective in the hands of an expert, but when placed in the hands of an inexperienced workman, under extreme

emergency conditions, may be less effective than more simple forms of first-aid protection. Whatever the equipment, make sure that workmen are thoroughly instructed in the hazards inherent to their particular jobs and trained in the proper use of the extinguishing equipment provided. To be effective, first-aid fire protection equipment must be used promptly and by persons familiar with its use and limitations.

9. AUTOMATIC SPRINKLER PROTECTION.

a. Importance.—The most important and effective fire protection device for manufacturing properties is the automatic sprinkler. Under average conditions, when properly installed, and with ample water supplies, automatic sprinkler protection rates over 90 in a scale where 100 represents perfection in total fire protection. The importance of automatic sprinkler protection cannot be over-emphasized in the protection of munitions plants against loss by fire. Manufacturing properties having important values in single fire areas of combustible construction or occupancy are not suitable for the production of munitions in war emergency without thoroughly reliable automatic sprinkler protection.

b. Effectiveness.—Seventy percent of all fires occurring during the last 40 years under automatic sprinkler protection have been practically or entirely extinguished by sprinkler protection alone. An additional 26 percent of such fires have been held in check, making the efficiency of automatic sprinkler protection approximately 96 percent perfect. In this same period, over 50 percent of the fires occurring under automatic sprinkler protection have been controlled by one or two heads. Over 80 percent of such fires have been controlled by less than eight sprinkler heads; excellent evidence of the prompt effectiveness of automatic sprinkler protection. No other single fire protection device has proved so effective in reducing interruption of production caused by fire.

c. Provision for adequate water supply.—Where fire department connections are provided to the sprinkler system, arrangements should be made with the fire department to make use of them in case of fire. The prompt use of such equipment may offset, to some extent, a delay due to a closed valve or obstructed yard system. Fire department pumpers should take suction from city mains or other sources outside the yard system wherever possible in order not to interfere with the functioning of the automatic sprinkler system.

d. Inspection of control valves.—In time of war every munitions manufacturing plant should make a daily inspection of every sprinkler control valve with a written record of its condition. The hazards resulting from a closed valve are so great that no sprinkler valve should be operated except on authority of the plant protection supervisor, plant engineer, or master mechanic. Sprinkler valves closed for repairs should be properly marked by a distinctive tag or other means and a suitable and prominent reminder of the condition left on the desk of the master mechanic or other responsible official for follow-up. When necessary to close a sprinkler control valve temporarily, a competent and reliable watchman should remain constantly at such valve to open it promptly in case of fire.

e. Control valves.—All sprinkler valves should be sealed open in a manner that will positively assure that should they be tampered with the condition will be apparent. The positive assurance that sprinkler control valves are maintained wide open is an essential item in all inspections of automatic sprinkler systems.

✓ **10. INSPECTION REQUIREMENTS.**

In addition to daily sprinkler valve inspections, make regular inspections of *all* fire protection equipment at least weekly. These inspections should be made by capable and trustworthy men who will record conditions found on suitable report forms. These records should be carefully checked by the plant protection supervisor, and any defects or deficiencies reported must be promptly corrected. Inspections also should include a careful check of housekeeping conditions and the disposition of combustible waste material. All equipment for the protection of hazardous processes must be examined, new hazards should be noted, and recommendations made to the appropriate official in order that adequate protection may be provided.

✓ **11. FIRE PREVENTION EDUCATION.**

A continuous fire prevention program should be conducted for the education of employees. Every employee engaged in work which may involve fire hazards should receive instructions as to proper procedures to avoid fires. All employees should be instructed in general fire prevention matters, to include the importance of refraining from smoking in prohibited areas, general cleanliness, the need for keeping fire doors and fire extinguishers unobstructed, and what they are expected to do in case of fire.

✓ **12. PLANT FIRE BRIGADES.**

The development of the plant fire fighting organization should start at the points of greatest fire hazards, the operating departments. Every operating department should have a fire squad trained in attacking and extinguishing fires which may start within its area. Beyond this, most plants need a well organized fire brigade composed of trained men from all departments who are fully familiar with the plant fire fighting equipment, and who are able to assemble quickly to take over from department fire squads any fire which threatens to get beyond their control.

The fire brigade will not be a success unless recognized by the management as a highly important department. The chief of the fire brigade should report and be responsible to an important executive in the plant organization. He should not be under the direction of the production superintendent or others to whom production necessities may suggest short cuts which sacrifice safety. The strength of the fire brigade, the amount of equipment, and the frequency of drills will depend upon the size of the plant and the nature of its hazards. In plants having fire pumps, the plant engineer or his chief assistant should be a member of the fire brigade. An electrician familiar with the power circuits should also be a member. It is desirable to include watchmen or maintenance employees on duty when the plant is not operating. Plants operating more than one shift should have a trained fire brigade for each shift.

✓ 13. FIRE ALARMS.

a. Fire alarm boxes.—Where there is a public fire alarm system, there should be a fire alarm box conveniently located for the prompt transmission of alarms in the event of fire. If desired, this box may be connected to auxiliary stations in the plant so that the operation of private box will transmit the alarm to the public fire department as well as notify the plant fire brigade and other plant officials.

b. Central alarm stations.—Large plants may require a central alarm station independent of the public system. This central station provides a point not only for receiving alarms but for supervising the plant police force and watchmen, and, when outside help is needed, may send calls to the public fire and police departments. As few plants are large enough to warrant operation of their own central stations, privately operated central stations in most principal cities provide reliable central station service and supervision for a large number of properties.

c. Automatic systems.—Fire alarm systems which are automatic in their operation are often a desirable form of protection for manufacturing properties. These automatic fire alarm systems are heat actuated. The alarm is transmitted through electric wires or by systems of air tubing. The reliability of such systems depends on the supervision that is given to them.

d. Supervision essential.—Unsupervised fire alarm systems, either manual or automatic, are unreliable.

✓ 14. WATER SUPPLIES.

No fire protective system is better than its water supply. Public water systems, gravity tanks, fire pumps, and private reservoirs are the usual sources of water supplies. In most large plants, two or more independent water supplies are necessary for reliability. In the event of shut-off or failure of one supply the other will be available. It is sometimes necessary to obtain a greater total volume of water than can be obtained through a single source. Absolute reliability of water supply must be assured at all important munition plants.

Secondary sources of water supply are secured through such means as gravity tanks and fire pumps. These must be properly maintained. Adequate maintenance may be assured by periodic inspections and tests under competent engineering supervision.

Water supplies should be used to the best advantage. The fire brigade chief should have a clear idea of the total amount of water available and should not use more lines than can be supplied adequately at good pressure. It is better to maintain good pressure at the sprinklers and supply a few strong hose streams that will reach the heart of the fire, than to rob the sprinklers or have a large number of feeble and ineffective streams.

✓ 15. COOPERATION WITH PUBLIC FIRE DEPARTMENT.

It is important that the public firemen be given an opportunity to become familiar with the private fire protective system of the plant. When private protection is laid out, provision must be made for an ample supply of water to sprinklers. If a fire occurs and opens an unusually large number of heads,

there may not be sufficient water to supply both sprinklers and hydrants from the same system. In such cases, fire department pumpers should not take suction from the yard systems but should furnish additional water from outside suction sources.

When water supplies are limited and many sprinklers open, generally the best use can be made of fire department pumpers by connecting them to fire department connections and pumping from city mains directly into the sprinkler systems. Fire departments in many well regulated communities have standing instructions for the first or second pumper arriving at a fire to connect up in this way.

16. RESPONSIBILITY ESSENTIAL.

In a serious fire emergency it is essential to avoid divided or obscure responsibility. A definite understanding must be reached between the plant management and the local fire department. Plans for meeting a serious fire situation must definitely place the fire-fighting responsibility in the hands of *one individual* with complete and undisputed authority.

VI. ACCIDENT PREVENTION

1. THE IMPORTANCE OF A SAFETY PROGRAM, AND ITS PRINCIPAL FACTORS.

Injuries to personnel have resulted in serious delays to war production. In 1941, over 480,000,000 man-days were lost because of accidental industrial injuries. The magnitude of the accident problem demands aggressive organized effort to conserve manpower in this war emergency. The problem is aggravated by the demand for speed, and the increasing demand for the substitution of women and older men to replace those who are drafted for military service. The War and Navy Departments therefore require that plants with prime and subcontracts, and facilities important to the prosecution of the war which have not already done so, expand their safety and health programs to meet the exigencies of the manpower shortage. Briefly, this calls for—

- a. An effective safety organization.
- b. Careful selection, training, and placement of employees.
- c. Intensive shop supervision.
- d. Disciplinary control of unsafe work practices by employees.
- e. Maximum use of personal protective equipment and clothing.
- f. Special provision for guarding against physical and mechanical exposures.
- g. Emphasis on safety promotion and education.
- h. Adequate first-aid and medical facilities.
- i. Accident records sufficient to evaluate the effectiveness of the program, and progress made.

If both management and employees are interested in safety and are active in making the plant a safe and healthy place in which to work, the results will be clearly apparent in the plant's safety and health record. This can be

accomplished best by the wholehearted cooperation of management with employee representatives in establishing efficient methods of finding and correcting the specific conditions and circumstances which cause personal injuries and illness.

2. SAFETY ORGANIZATION.

Accident prevention work is essentially a simple and understandable procedure. It requires only that the conditions and circumstances which in all probability will cause accidents be found and corrected. Most accidental injuries result from two causes: (1) the violation of a commonly accepted safe practice rule; or (2) exposure to a mechanical or physical hazard.

A safety organization is most effective when the simplicity of real accident prevention work is kept in mind continuously, and when the chief objective of the organization is that of finding and correcting those specific unsafe practices of employees and mechanical hazards that have caused accidents in the past, and may be expected to cause accidents in the future.

The first requirement of any safety organization is that management actively participate. Personnel should include a safety director, safety inspectors, and safety committees. The safety director, as the direct representative of management, plans and directs all safety activities, and is responsible to management for the effective functioning of the safety program.

Safety inspectors survey structures, yards, storage spaces, machines, tools, equipment, materials, safety appliances and equipment, and safe work performance. They report findings and recommendations, or if necessary correct unsafe conditions and circumstances on the spot. They also investigate accidents, prepare records, and assist generally in safety work.

The safety committee serves as a clearing house and forum, considering (a) the progress of safety work; (b) recommendations from all sources; (c) accident investigation; (d) the quality of safety work by all participants in the program; (e) educational and promotional activities; and (f) the correction of outstanding mechanical and personal causes of accidents.

The key man in every safety plan is the foreman. He is closely associated with the employees under his charge and his personal influence and example, as well as his authority, provide him with a degree of control that is of great importance in safety work. He is in the best possible position to know the hazards and to enforce safe practice rules. No safety program can hope to be successful without the sympathetic and intelligent support of competent foremen.

3. UNSAFE PRACTICES.

The great majority of industrial injuries occur because employees violate commonly accepted rules. Therefore, in any safety program aggressive effort must be made to devise practical methods of correcting unsafe practices, and of creating safe work habits on the part of all employees. Consideration should be given not only to traumatic injuries but to health as well.

4. PROTECTIVE EQUIPMENT AND CLOTHING.

The most careful worker is nevertheless likely to sustain injury if he is exposed without adequate personal protective equipment or clothing while

engaged in an operation which requires such personal protection. Suitable personal protective equipment and clothing must be provided and used where necessary.

5. PHYSICAL HAZARDS.

Buildings and other structures should be safely designed, constructed, and maintained; dangerous moving parts of machines, tools, and other mechanical equipment should be guarded; safe housekeeping should be maintained; exit and entry facilities should be adequate to meet any emergency situation; and manufacturing, processing, storage, and transportation in general must be in accordance with accepted safe practice.

6. EDUCATION AND PROMOTION.

Safety posters or bulletins, notices, slogans, and accident records in general should be prominently posted for the purpose of informing the personnel, creating and maintaining interest in safety, and publicizing the status of the safety effort. Consideration also should be given to safety contests, together with prizes and awards.

7. RECORDS ESSENTIAL.

Records with regard to accidents and injuries must be maintained so that the essential facts of accident occurrence, and accident prevention may be developed and utilized.

8. COOPERATION WITH OTHER AGENCIES.

Accident prevention "on the job" and "in the plant" is a primary responsibility of plant management. However, the manpower situation demands that efforts to insure safety and health be extended to the home, and to transportation to and from work. Consequently, it is essential to seek the cooperation of chambers of commerce, defense transportation committees, police and traffic officials, railroad, trolley and bus companies, State and local safety councils, and any other agency or group eager to utilize its authority and resources to help win the war "on the home front."

9. COMPLIANCE.

A great many plants are well organized for accident prevention; others require considerable improvement in the scope and measures taken to conserve manpower. Inspections are made by the War and Navy Departments, often with the assistance of the United States Department of Labor, the Office of Civilian Defense, and other agencies, to determine the efficacy of the safety and health program in any plant or facility, and to make recommendations for improvements. Compliance with recommendations is predicated upon a spirit of cooperation.

VII. GUARD FORCES

1. GENERAL REQUIREMENT.

It is required that all plants and facilities important to the prosecution of the war, not located in loft or tenanted buildings, provide an efficient and well-trained guard and watchman force, adequate in personnel and in training to:

(a) protect all vital and restricted areas and war materials at the plant or

facility; (b) guard entrances not locked; (c) check carefully all persons, vehicles and materials entering or leaving the plant; (d) oversee traffic within the plant; (e) enforce rules and regulations essential for protection against fire, safety and other hazards; (f) make patrols and watchmen-rounds with adequate frequency; and (g) perform such other protective duties as may be necessary.

✓ **2. UNIFORMS.**

In large plants, guards should be furnished with uniforms and in all plants, regardless of size, guards should be provided with suitable badges and proper credentials. Complete uniforms help to build up the morale of the guard force and create respect for the wearer on the part of the other employees and outsiders.

✓ **3. ARMS AND EQUIPMENT.**

In addition to the usual equipment such as flashlight, keys, notebook, and similar articles, guards in all important plants should be armed and adequately trained in the care and use of the weapons furnished.

✓ **4. SELECTION OF GUARDS.**

One of the most important requisites of the guard force is that it be composed of vigorous, intelligent, well-trained, self-reliant men, preferably not over 60 years of age. Able-bodied men of more advanced age may be used as watchmen. Qualified women may be utilized if necessary as guards or watchmen.

✓ **5. INVESTIGATION AND FINGERPRINTING.**

Guards should fill out the plant's regular application form for employment and special investigation should be made of their personal history, citizenship, society and organization membership, general reputation, background, and financial condition. Fingerprinting of guards and watchmen is essential. Employment of an alien as a plant guard must be approved by the Secretary of War or the Secretary of the Navy in the same manner as employment of an alien having access to work on classified or aeronautical contracts.

✓ **6. TRAINING REQUIREMENTS.**

Plant guards and watchmen must be made to realize the importance of their jobs. It is the definite responsibility of management to provide suitable instructions and training to assure the competency of its personnel. It is extremely important that all guards be qualified and thoroughly trained in the care and use of firearms. Firearms should be properly stored and maintained in perfect working order at all times.

Guard forces cannot be considered as adequately trained unless they are thoroughly familiar with—

- a. All common forms of espionage and sabotage activities.
- b. Entire plant area, with particular reference to restricted and vital areas.
- c. Location and character of hazardous materials and processes.
- d. Use and location of all fire protective equipment, including sprinkler control valves.

- e. Conditions which may cause fires.
- f. Location and operation of all important steam and gas valves and all main electric switches.
- g. First-aid methods and location of all first-aid equipment for use in case of accidents.
- h. Duties in event of fire, blackouts or air raids.
- i. Action to be taken in any other emergency that can be foreseen.
- j. Use of plant communication system.

✓ **7. ORGANIZATION.**

Guard and watchman forces should be organized under the direction of an appropriate plant official and operate directly under the supervision of a chief of guards. One man should be placed in charge of each shift of the guards or watchmen. In small plants, the chief of guards may assume this function on the day shift with a subordinate on the night shift. Except in small plants in tenanted buildings, or small plants which are locked at night and have only minor war production contracts, guard or watchman service should be on a 24-hour basis.

Guards should be assigned to shifts in accordance with local requirements, but the change of guard shifts should be so scheduled that it will not coincide with employee shifts.

✓ **8. RULES, REGULATIONS, AND RECORDS.**

A comprehensive set of rules and regulations governing the guard force should be prepared by the plant protection official and a copy furnished each member of the force. A list of telephone numbers for use in emergency should be in guard headquarters. Written records covering all guard activities should be maintained.

✓ **9. DUTIES OF GUARDS AND WATCHMEN.**

See paragraph 8c, Chapter I, "Sabotage and Espionage."

✓ **10. GUARD COMMUNICATION SYSTEMS.**

In large plants a satisfactory communication system for the use of guard forces must provide for the positive identification of the guard calling in; permit the summoning of single guards, or all guards simultaneously; and definitely indicate the location from which a call is made.

Guards should be required to report on an hourly basis and accurate records should be kept of the time such reports are received. In the event of failure of a guard to report on time, an immediate investigation should be made.

Watchmen's rounds may be recorded by either a stationary or portable clock, with or without connections to a central station at the plant or outside. Watch-clock records should be supervised by an official of the plant and be checked regularly to make sure that there has been no tampering.

✓ **11. MILITARIZATION OF PLANT GUARD FORCES.**

a. *Necessity and purpose.*—So important are our war industries to the prosecution of the war that the Secretary of War and the Secretary of the Navy, acting under authority of the President, have ordered the militariza-

tion of plant guard forces at important plants and facilities. The purpose is to increase the authority, efficiency, and responsibility of guard forces, and through military training to provide auxiliary forces throughout the United States to supplement the Army and Coast Guard in wartime emergency situations. Special and detailed War Department orders govern the organization, training and command of guard forces so organized.

b. Emergency situations defined.—An emergency situation in which the Auxiliary Military Police or the Coast Guard Police may be called upon may arise from flood, conflagration, or other disaster, internal disorders hazardous to property or production important to the prosecution of the war, enemy action by air raid, fifth column activity, paratroop attack or invasion, or may arise from any other condition or circumstance involving the plant or its community making it necessary to place in operation one or more of the emergency plans of the War Department or of the service command.

